

# LEADING, LAGGING, SYNCHRONIZED? BUSINESS CYCLES OF EU COUNTRIES BEYOND EUROZONE

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## Abstract

The theory of optimum currency area is an important reference point in analyses of monetary integration processes. According to the optimum currency area theory one of the most important factors for countries planning to form a monetary union is business cycle synchronisation. The aim of the paper is to evaluate the level of business cycles' synchronisation of European countries beyond euro zone with the fluctuation observed in the euro area. There are a few methods which are applied: periodograms, concordance index and cross-correlation coefficients. The results show that, on the basis of chosen measures, analysed countries exhibit relatively good level of business cycle synchronisation. Slightly worse result are obtained for Romania, both in case of cycle's length and phase similarity.

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**Keywords:** Business cycle, optimum currency area theory, business cycle synchronisation

## Introduction

Undoubtedly, the optimum currency area theory (OCA) from the early 1960's still remains a benchmark for monetary unification analyses. OCA theory focuses on defining the main factors that are crucial from the point of view of the successful currency area formation. Throughout the decades many economists contributed widely to the theory development formulating a list of assumptions that allow to verify whether the currency area can be characterized as optimal. However, OCA theory is not free from some imperfections. That is why it came under a wave of criticism formulated recently by many economists (Mongelli, 2008 and 2002; Corsetti, 2008, Bien, 1988; Mayes and Suvanto, 2007). Those economists postulated that most of the assumptions of the OCA theory is quite difficult to verify empirically. Thus, most empirical investigations concerning OCA theory are predominantly based on the one of the measurable criteria - business cycle synchronisation. The existence of such synchronization is indispensable from the point of view of the effective common monetary policy, in particular, in the area of mitigating economic fluctuations. For this reason, we analyze business cycles of European Union countries, which are planning to join euro area. The main objective of this paper is to assess on the basis of chosen indices and statistical measures which of the analyzed countries has the most similar business cycle to the fluctuations observed in the euro area as a whole.

## Optimum currency area theory

The beginning of optimum currency area theory dates back to early 1960s. The origin of this theory is associated with the debate on the exchange rate regimes (Komarek, Cech, Horvath, 2003) and it became one of the foundations of monetary integration analyses. The OCA theory was pioneered by Mundel (1961) and then gradually developed by many prominent economist (McKinnon, 1963, Kenen 1970, Grubel, 1970). They significantly expanded the basic Mundel's theory formulating many new criteria, from which the most important to mention are: the mobility of production factors (geographical, sectoral and

occupational), openness of economies and their diversification, similarity of economic policies (especially in terms of low inflation), the low volatility of the exchange rate and synchronisation of business cycles (Biegun, 2004 , De Grauwe, 2000; Krugman and Obstfeld, 2009; Lachowicz, 2008; Rose and Engel, 2002).

Mundel (1961) also presented first definition of optimum currency area, characterising this area as a region inside of which circulates one currency or a few currencies but with a fixed exchange rates. During the further developments of optimum currency areas theory Mundell's definition was modified and supplemented. Nowadays, the most popular definition of optimum currency area is based on the costs and benefits analysis of adopting common currency. This means that countries should form a currency area only when establishing fixed exchange rates leads to advantage of benefits (Grubel, 1970).

The early years of 1970's are treated as a beginning of, so called, new OCA theory. The higher emphasis is here put on the problems of financial integration, inflation rate convergence and low exchange rate variability (Wojnicka, 2002). Economists who developed the new OCA theory claim that of a high importance for a successful monetary integration is the fact that countries which want to form currency area have similar monetary and fiscal policy and synchronised business cycles.

### **Business cycle synchronisation – literature review**

The business cycle synchronization analysis may be conducted on the basis of the wide range of econometric and statistical methods. Skrzypczyński (2006) examines the synchronisation of Polish and euro area business cycles using the methodology based on the time series analysis which involves time and frequency domain analysis. Thus, the author can verify not only the synchronisation of the business cycle phases but also determine whether the size of their amplitude is similar. The results of this study shows that there is a high level of business cycle synchronization between fluctuations observed in euro area and business cycles of Germany, Austria, France, Belgium and the Netherlands, moderate similarity for Italy, rather weak in the case of Spain, Greece and Ireland, and very poor for Finland and Portugal.

Alternative research of the synchronisation of economic activity was presented by Bergman (2004). The analysis shows that business cycles of European countries exhibit quite a high degree of synchronisation. Moreover, the author concludes that during the last 10 years of the economic and monetary integration business cycles of EU countries have increased the degree of their synchronization, especially in the case of cycles' phases. However, Bergman reveals that the reverse process - increasing divergence, can be seen in terms of the fluctuations' amplitude. Bergman claims that this may be the evidence for the ineffectiveness of the common monetary policy, which may be too expansionary for some countries in the monetary union and at the same time too restrictive for others.

Interesting empirical study of business cycle synchronization between new members of the EU and the euro area as a whole was conducted by Wozniak and Paczyński (2007). Authors are using Kalman filters. This method enables to verify the strength of the synchronisation of business cycles depending on the length of the cycle. The results show that the synchronization of fluctuations between the new member states and the euro area as a whole is relatively weak for long cycles (lasting three years or longer). The highest level of synchronisation was observed for the cycles lasting form 4 to 7 quarters - a typical horizon of monetary policy.

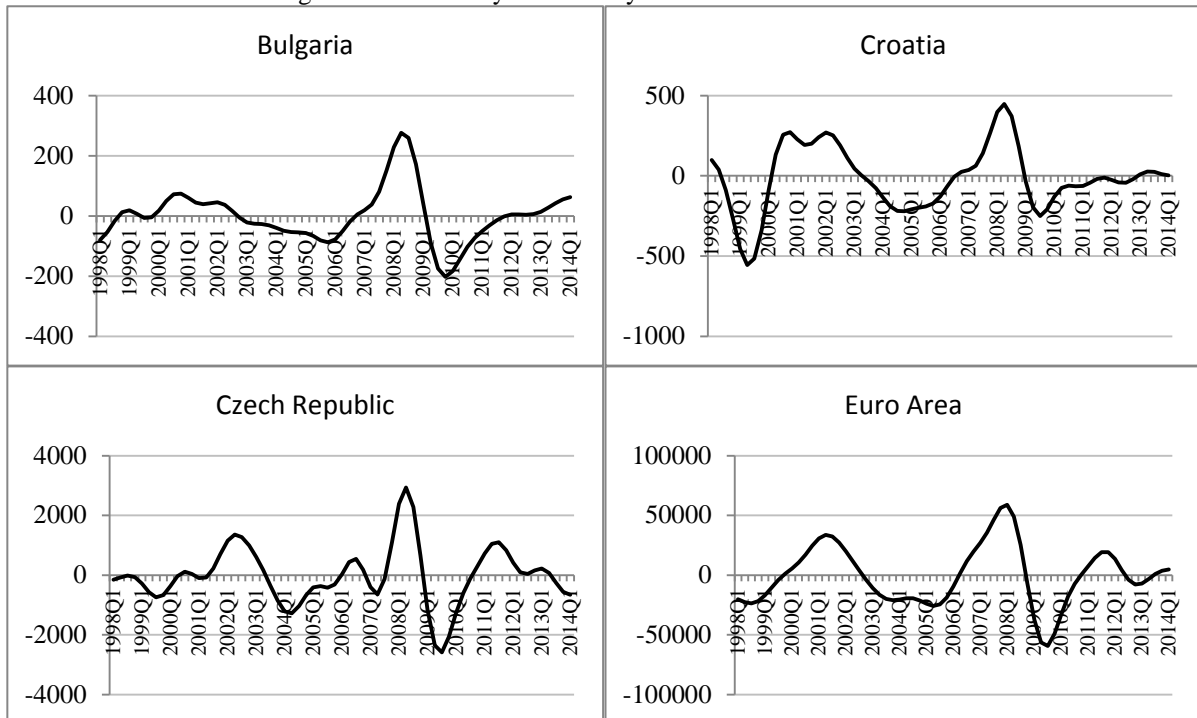
Results of the presented analyses cannot give the clear answer to the question about the level of the business cycle synchronisation of European Union countries. Many studies have confirmed the existence of a strong business cycle synchronization among the euro area countries. However, the diversity of methods and measures used in these analyses,

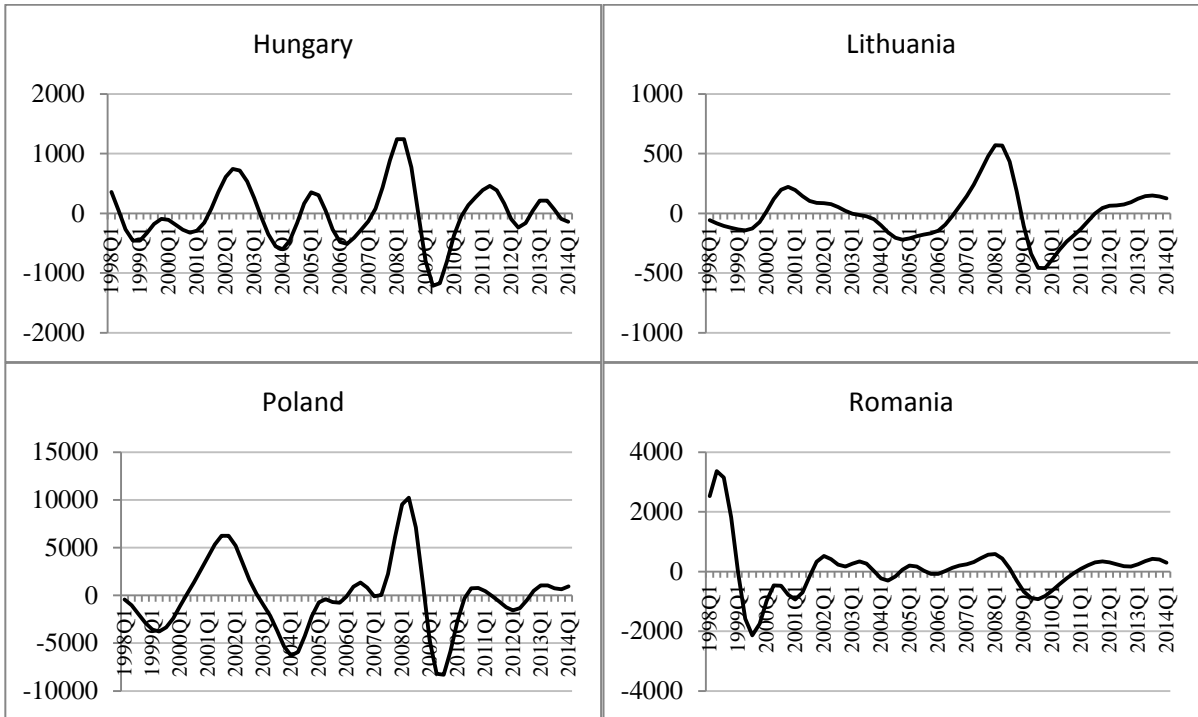
unfortunately makes it impossible to give any general conclusions. Another attempt of empirical investigation of the synchronisation of business cycles of the countries which plan to join euro area is provided by the following statistical study.

**Business cycles analysis - empirical results**

The empirical investigation concerning the business cycles of selected EU is based on quarterly data of gross domestic product (GDP) covering the period form 1998.1-2014.1. Data was taken from Eurostat database. The quarterly economic time series display a strong seasonal pattern that is why it is necessary to do seasonal adjustment. Here a TRAMO/SEATS method was applied. Next, in order to isolate form GDP series a cyclical component the times series were filtered - Christiano-Fitzgerald (1999) frequency filter (CF) is used. All time series were non-stationary I(1) that is why before using CF filter a drift had to be removed. Finally the fluctuations at a frequency between 6 and 32 quarters (1,5 year and 8 years) were extracted. Such fluctuation frequency was chosen according to Burns-Mitchel (1946) definition of business cycle. These authors define business cycle as quite regular, but not strictly periodic fluctuations in economic activity with a duration usually between one and ten years. Time series of GDP which were a in such way transformed are treated as the representation of the co-movement and are presented in Figure 1. Analysing fluctuations in Figure 1 one can notice the existence of some similarities between business cycles of particular countries. However, in order to get to know which countries' business cycles are better synchronised with fluctuations observed in euro area it is necessary to apply additional measures.

Figure 1. Business cycles in analyzed countries and euro area

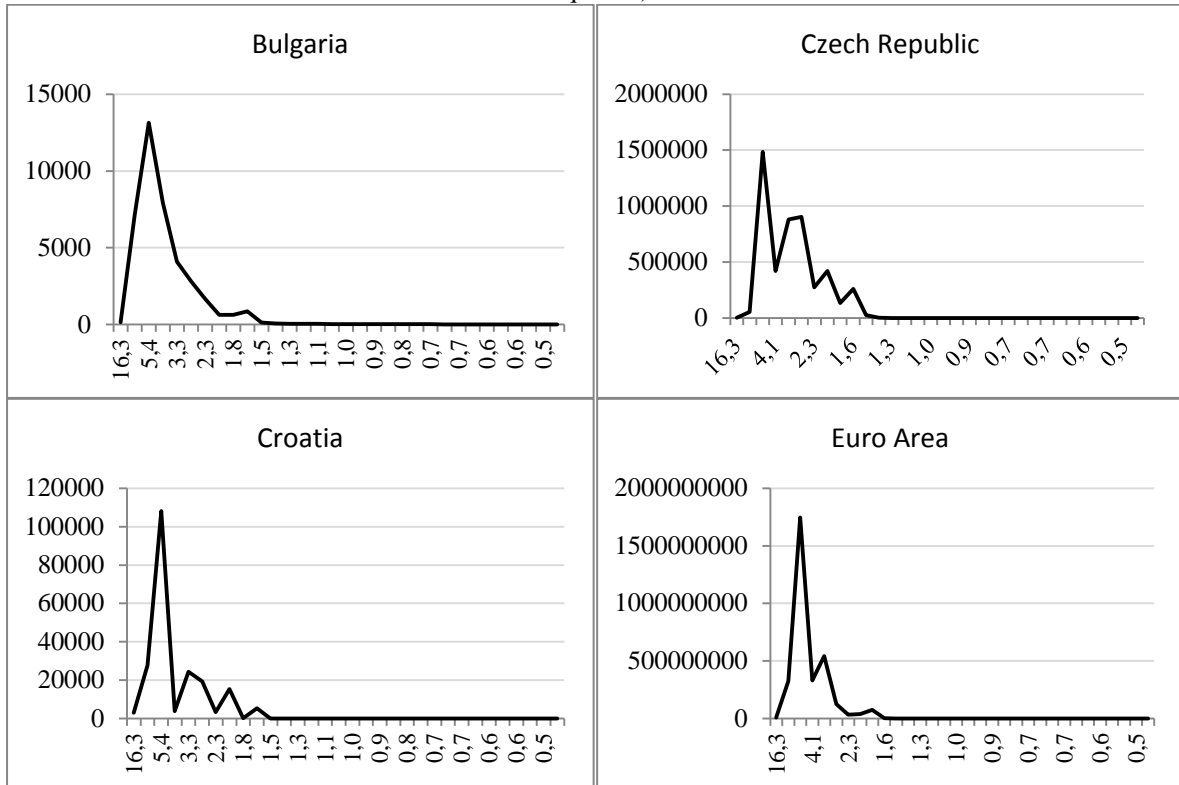


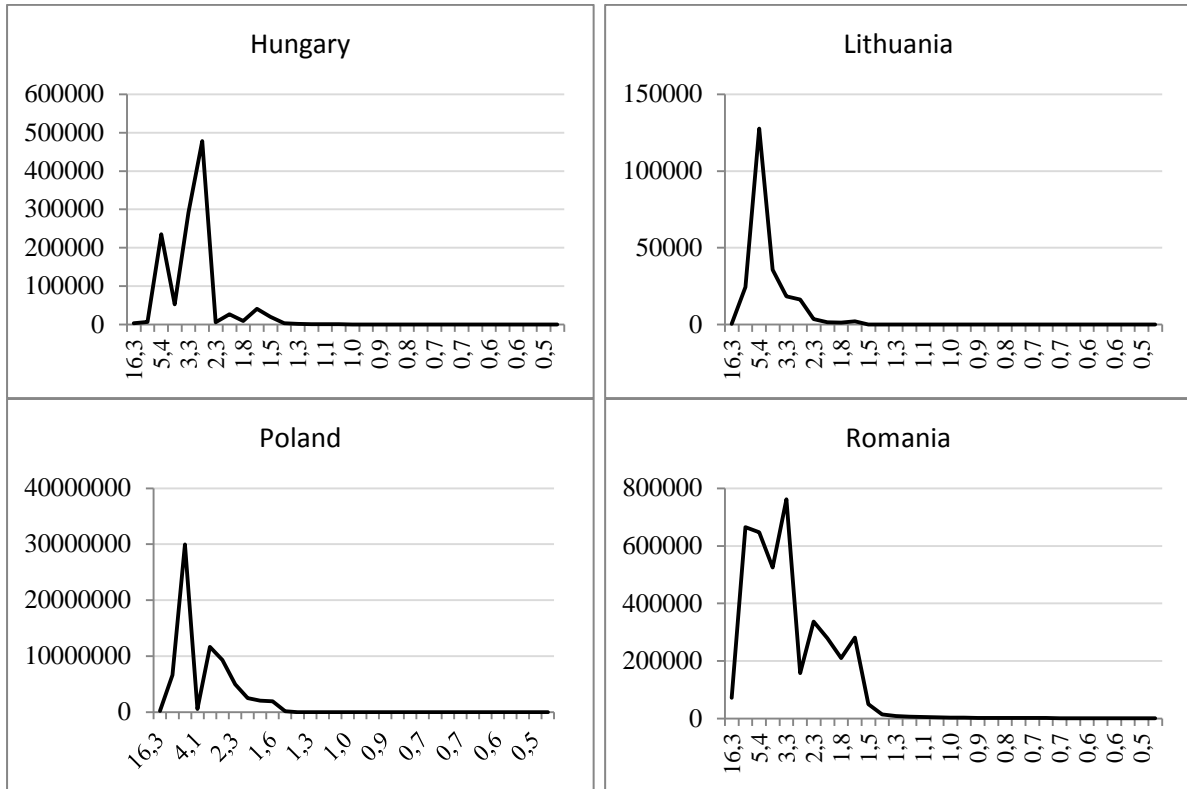


Source: own calculations based on Eurostat data.

In order to check which business cycle length is dominant in each country, periodograms are used (Figure 2). The analysis of the periodograms confirms that all countries with the exception of Romania have the dominating business cycle length of 5,4 quarter, what corresponds with the frequency of fluctuations in the euro area. While in Romania the most frequent business cycle length is 8,1 quarter which significantly departs from the results for other countries.

Figure 2. Periodograms of business cycles of analyzed countries and euro area (horizontal axis – number of quartes)





Source: own calculations based on Eurostat data.

Form the empirical point of view it is interesting to evaluate how often business cycles are in the same phase. It is possible to measure it using the concordance index, which was presented by Artisa, Marcelinno, Proietti (2002). It enables to determine the percentage of time in which business cycles are in the same phase. Concordance index has the following formula:

$$I_{ij} = \frac{1}{T} \sum_{t=1}^T [S_{it} S_{jt} + (1 - S_{it})(1 - S_{jt})],$$

where:

S<sub>it</sub>, S<sub>ij</sub> – binary series for business cycles representing its phase (1 for expansion and 0 for recession).

Table 1. Concordance indices for analyzed countries via euro area

Country	Concordance index (via Euro area)
Bulgaria	0,738
Czech Republic	0,692
Croatia	0,707
Hungary	0,584
Lithuania	0,800
Poland	0,784
Romania	0,600

Source: own calculations based on Eurostat data.

Table 1 presents the values of concordance indices for analyzed countries with respect to euro area. The highest values of the concordance indices are obtained for Lithuania and Poland. Business cycles of these countries are in the same phase as business cycle of euro area in, approximately, 80% of analyzed period of time. The lowest indices one can notice in case of Hungary (58%) and Romania (60%).

Last business cycle characteristic which seems to be interesting from the point of view of future monetary integration are the business cycles shifts. By the use of cross-correlations it is possible to find out if business cycles of particular countries are leading or lagging in relation to fluctuations in euro area. Cross correlation coefficients presented in Table 2 show that business cycles of most analyzed countries are one to two quarters lagged compared to euro area business cycle. The best business cycle timing according to calculated indicators one can find for Poland - the highest value of correlation coefficient is obtained for period t and t+1. The lowest values of indicators are computed for Romania. What's more, all of them are statistically insignificant.

Table 2. Cross correlations between particular country's business cycle and fluctuations in euro area

Country	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4
Bulgaria	-0,28**	-0,06	0,21*	0,50***	0,73***	0,86***	0,86***	0,74***	0,55***
Czech Republic	-0,23*	-0,02	0,25**	0,52***	0,71***	0,77***	0,69***	0,51***	0,29***
Croatia	-0,20*	0,02	0,27**	0,50***	0,68***	0,77***	0,76***	0,67***	0,53***
Hungary	-0,28**	-0,03	0,24***	0,49***	0,64***	0,67***	0,57***	0,39***	0,18
Lithuania	-0,12	0,14	0,43***	0,68***	0,85***	0,91***	0,85***	0,69***	0,48***
Poland	-0,04	0,19	0,46***	0,69***	0,83***	0,83***	0,70***	0,49***	0,25**
Romania	-0,19	-0,14	-0,08	-0,01	0,04	0,10	0,15	0,16	0,12

Source: own calculations based on Eurostat data

\*, \*\*, \*\*\* - indicate 10%, 5% and 1% significance level respectively

## Conclusion

Nowadays, it is widely argued that the business cycle synchronization is indispensable for a successful monetary integration. Such homogeneity is desirable from the point of view of common monetary policy. If business cycles are more similar the common monetary policy is more effective.

The results of the empirical investigation show that business cycles of most of analyzed countries are relatively well synchronized with the fluctuations observed in euro area. Cycles have similar, dominant lengths and are only slightly lagging (about one to two quarters) in comparison with euro area business cycle. A little bit worse results are obtained in case of Romania. This country's business cycle is characterized by longer dominant length and is relatively moderately correlated with euro area fluctuations.

## References:

- Artis M., M. Marcellino, T. Proietti: Dating the Euro Area Business Cycle, European University Institute Working Paper, 2002.
- Bergman U.M.: How Similar Are European Business Cycles?, EPRU Working Paper No. 04-13, 2004.
- Biegun K.: Kryteria optymalnego obszaru walutowego w rozszerzonej unii Europejskiej (in:) Manikowski A. (eds.), Psyk A. (eds.): Unifikacja gospodarek europejskich. Szanse i zagrożenia, Wydawnictwo Naukowe Wydziału Zarządzania uniwersytetu Warszawskiego, Warszawa 2004.
- Burns, A. F., Mitchell, W. C.: Measuring Business Cycles. N.Y.: National Bureau of Economic Research, New York, 1946.
- Bień A.: Optymalny obszar walutowy. Teoria i praktyka, PWE, Warszawa, 1988.
- De Grauwe P.: Economics of monetary union, Oxford University Press, Oxford, 2000.
- Grubel H.G.: The Theory of Optimum Currency Areas, Canadian Journal of Economics, 1970.
- Christiano, L. J., Fitzgerald, T. J.: The Band Pass Filter. Working Paper No. 9906, Federal Reserve Bank of Cleveland, 1999.
- Corsetti, G. A.: Modern Reconsideration of the Theory of Optimal Currency Areas. European University Institute Working Paper, February 2008.

- Kenen P.B.: The Theory of Optimum Currency Areas: an Electric View, (w:) Mundell R.A. (eds.), Swoboda A.K. (eds.), Monetary Problems of the International Economy, Chicago University, Chicago, 1970.
- McKinnon R.I.: Optimum Currency Areas, American Economic Review Vol. 53, No. 4, 1963.
- Mongelli, F.P.: European economic and monetary integration and the optimum currency area theory. No. 302 European Economy, Economic Papers, European Commission, 2008.
- Grubel H.G.: The Theory of Optimum Currency Areas, Canadian Journal of Economics, 1970.
- Komárek, L., Čech, Z., & Horváth, R.: Optimum Currency Area Indices: How Close is the Czech Republic to the Eurozone?. Czech National Bank, 2003.
- Krugam P.R., Obstfeld M.: International economics: Theory and policy, 8/E. Pearson Education India, 2009.
- Lachowicz M.: Koncepcja wspólnych obszarów walutowych, Bank i Kredyt, Warszawa, February 2008.
- Mayes. D.G., Suvanto A.: Meeting the Challenge of Monetary Union: Lessons from the Finnish Experience, Bank i Kredyt, Warszawa, October 2007.
- Mundell R.: A Theory of Optimum Currency Areas, American Economic Review, nr IX, 1961.
- Rose A.K., Engel C., Currency Union and International Integration, Journal of Money, Credit and Banking, Vol. 34, No. 3, 2002.
- Skrzypczyński P.: Analiza synchronizacji cykli koniunkturalnych w strefie euro, Materiały i Studia, Zeszyty no 210, 2006.
- Wojnicka E.: Spory wokół teorii optymalnych obszarów walutowych, Ekonomista, no 1, 2002.
- Woźniak P., Paczyński W.: Business Cycle Coherence between the Euro Area and the EU New Member States: a Time-Frequency Analysis, [www.cerge-ei.cz/pdf/gdn](http://www.cerge-ei.cz/pdf/gdn), 2007.